Micromite™ T instruction manual

Part # E 2720
11/15/91

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how to use this manual

This manual contains all the information required to operate your new indicator/calibrator.

Before you use the instrument, we recommend you read this manual completely and review all the features and capabilities of the instrument. The manual is designed to make the use of the instrument as easy as possible. Simply refer to the table of contents on the preceding pages to locate the directions for any operation you require.

A Service Manual, including the calibration procedure, schematics and parts list, is available at a nominal charge.

Should you wish to purchase this Service Manual or need any additional information, call your sales representative or our nearest office. The addresses and telephone numbers of our offices are listed in Section 5 of this manual.

Each indicator/calibrator has a label on the inside of the battery compartment cover. This label identifies the instrument's model number (product code) and serial number. Always refer to these numbers in any phone calls or correspondence about the instrument or when ordering parts.

introduction

about the instrument

The instrument is a thermocouple indicator/ calibrator that represents a major advance in hand-held industrial instrumentation. For the first time, you can easily take a laboratory grade instrument into your plant for precise measurement of temperature, millivolts and calibration of other instruments. The indicator/calibrator's light weight and battery operation permit convenient use anywhere - in your laboratory, plant or on a jobsite.

The instrument permits you to input or output direct temperature readings of:

- J, K, T, E, N, W5/W26, Platinel II, R, S & B thermocouples

In addition, you can use it to input or output:

- millivolts

Three output memories are available to let you set and select any temperature or millivolt value directly, through the numeric keypad.

With the ramping feature, you can select the ramp step increment and ramp up or down from any value set in the output memories. This makes calibrating and checking alarm trip points, deadbands, proportional bands and other adjustments a snap.

section 1 general care

1-1 unpacking

Unpack the instrument immediately upon receipt and check for shipping damage. If it was damaged in transit, please save the shipping carton and all packing material, report the damage and file a claim with the carrier.

Make sure you received everything you ordered by checking the items against the packing list before discarding the shipping container and packing material. Sometimes, small accessories are packed in the same carton as the instrument. If all items are not accounted for, call us immediately.

1-2 storage

Treat the instrument as you wouid any precision electronic equipment. When not in use, replace the cover to protect the keypad and display, and store it in a secure, clean, dry area. Storage temperature (without batteries) shcuid not be below -4°F or above 158°F (-20°C to 70°C). Remove the batteries if you don't plan to use the unit for a long period of time.

1-3 batteries

The instrument uses 6 disposable AA alkaline batteries. As fresh batteries were installed just before it was shipped, it is ready to use without any further preparation. In normal use, these batteries should last more than 70 hours. The battery compartment is located at the bottom of the back of the unit. Remove the cover by sliding it down in the direction of the arrow. When replacing the batteries, pay careful attention to the polarity indicated in the compartment. For best results, alkaline batteries should be used.

Avoid touching the battery contacts as this could contaminate the contacts and cause intermittent connections. We recommend you clean the contacts each time you replace the batteries.

1-4 AC adapter

115 V and 230 V AC adapters are optonally available. To use the unit with the adapter, turn it off, plug the adapter into an outlet and insert the other plug into the jack at the lower right side of the instrument. If you are using the 230 V AC adapter, you will have to install an appropriate plug on the power cord.

The instrument will not function if the cord is plugged into the jack without the adapter being plugged into a functional outlet. For reasons that will be discussed later, the instrument should be turned off by pressing the "On/Off" key, not by unplugging the AC adapter. Then you can remove the adapter from the outlet. For further details, refer to Section 2-3, page 5.

The use of an unauthorized AC adapter is not recommended and may void the warranty.

1-5 cover/stand

The indicator/calibrator has a cover which protects the keypad and display from damage. To use the instrument, slide the cover up and off its track and place it onto the back of the unit, with the name at the bottom of the instrument. The cover can be used as a stand by bending the lower half of the cover out at the hinge prior to sliding it on the unit.

Replace the cover to protect the keypad and display when the instrument is not in use or is being transported.

1-6 maintaining calibration

The instrument has several precision internal references. When it is calibrated, these internal references are accurately measured by one of the unit's microprocessors. The value of these references are then permanently stored in the instrument's memory.

During normal use, the instrument automatically recalibrates its own circuitry against those "known" references approximately every 15 seconds. This unique method of calibration enables it to maintain it's high levels of accuracy, stability and repeatability.

Since the unit is calibrated at the factory before shipment, it will give you precise, accurate results immediately. However, over time, the value of the internal references may change slightly as a natural result of aging. As this process varies from instrument to instrument, we recommend that your indicator/calibrator be tested and, if necessary, be recalibrated every six months to insure that it meets its specified accuracy.

The Micromite T should be tested and/or calibrated only by qualified personnel with appropriate equipment, as specified in the optional Service Manual. For the most reliable results, we recommend you return the instrument to:

Thermo Electric
109 North Fifth Street
Saddle Brook, NJ 07662
Attn: Instrument Service

section 2 operating instructions

2-1 warm-up

To obtain optimum accuracy, the instrument should be allowed to stabilize after being turned on. If it was recently subjected to a large change in temperature (e.g. if it was stored in the trunk of a car on an extremely hot or cold day and then brought inside a building), you should allow an hour at ambient temperature for temperature stabilization.

2-2 making your connections

One of the features of this new indicator/calibrator is its unique universal connector that accepts virtually any kind of input normally used on this type of instrument: wire, standard and miniature connectors, or single banana plugs. To make your connections, loosen the grey "Plus" (+) and "Minus" (-) knobs by turning them counter-clockwise, insert the wire or plugs and turn the knobs clockwise to tighten the connection. Do not overtighten.

Please refer to Sections 2.6 and 2.7, page 9, for specific instructions on how to connect the unit to sensors or other instruments.

2-3 turning the instrument on/off

Turn the unit on by pressing the "On/Off" key. The display will indicate **WAIT!** for a few seconds while the instrument is initializing and resetting itself to its last configuration prior to being turned off. When turned on, the instrument will always come up in the input mode.

To turn the unit off, press the "On/Off" key again. When the instrument is turned off, it stores, in its non-volatile memory, its last configuration, i.e. the sensor type, output memories, ramp step and °F/°C setting.

Do not turn the instrument off by uplugging the AC adapter or removing its batteries. This will not damage the instrument but will cause it to "forget" its last configuration. If the unit is accidently turned off by unplugging the AC adapter, removing the batteries or due to a power failure, the next time you turn it on, the display will indicate:

```
Reset!
Please Turn Off
```

This is a warning message informing you that the instrument has lost its configuration due to an improper procedure. Turn the unit off and on again. The instrument will default to Type J T/C.

NOTE If you are in the process of changing one of the "Select" key configurations (sensor type or one of the outputs or ramp step), you will **not** be able to turn the instrument off without first exiting the configuration mode by pressing the "Enter" key.

2-4 display messages

The instrument displays the following messages to inform you of its status:

WAIT! — The unit's microprocessor is making the calculations, comparisons and adjustments required to achieve its high accuracy.

Over range! or **Under range!** — The input or output "temperature" is over or under the sensor range.

Sensor is open! — Either no sensor is attached to the unit or the sensor that is attached is broken.

Reset! Please Turn Off — The instrument has stopped operating temporarily because of an improper procedure. Turn the instrument off and on again, at which time it will default to a Type J thermocouple.

Caution: Replace Battery — Batteries will last only about 4 more hours. This display will flash every 30 seconds. To continue operations, replace the batteries with fresh ones or use the AC adapter.

Unit requires Calibration! — The instrument has lost its calibration constants and is no longer able to function properly. Recalibrate it in your own laboratory or return it for recalibration.

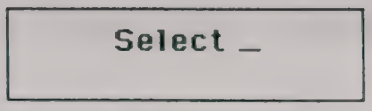
2-5 configuring the instrument

°F/°C Indication

You can change the temperature readings from Fahrenheit to Centigrade, or vice versa, by pressing the "°F/°C" key.

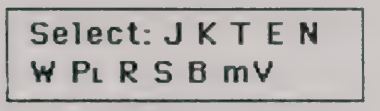
sensor type

To change the sensor type, press the "Select" key. The display will indicate:



NOTE If you press the "Select" key by mistake, you can return to the previous mode by pressing the "Select" key again.

Press the "Sensor" key. The display will indicate the sensor menu:



J, K, T, E, N, R, S, B = thermocouples
W = W_5W_{26} Tungsten Rhenium thermocouple
PL = Platinel II thermocouple
mV = millivolts

Note the blinking cursor. You can move this cursor to the right by pressing the Δ (up) key and to the left by pressing the ∇ (down) key.

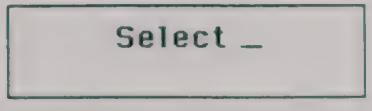
Select the sensor you wish to use and press the "Enter" key to load this sensor into the instrument's memory. After "Enter" is pressed, the unit will return to its previous mode.

When the sensor type is changed, the configuration is initialized as follows:

Output 1 - is set for the bottom of the selected sensor's range
Output 2 - is set for the middle of the range
Output 3 - is set for the top of the range
Ramp Step - 100.0 degrees, or 1.000 mV, depending on the sensor selected.

output memories

To change the output memories, press the "Select" key. The display will indicate:



NOTE If you press the "Select" key by mistake, you can return to the previous mode by pressing the "Select" key again.

Press the "Output" key for the output you wish to change (the "Output 1" key to change the contents of Output 1, the "Output 2" key to change the contents of Output 2, etc.). The display will prompt you by indicating:

```
Select Output #_ :
(Memory Contents)
```

Use the numeric keypad to input a new value into memory. The value can be changed from plus to minus and vice versa by pressing the "+/-" key. If you make a mistake, you can "Clear" your entry by pressing the "Input" and "Sensor" keys together and starting over again.

Press "Enter" to load the new value into the selected output's memory. After "Enter" is pressed, the instrument will return to its last mode of operation. The new value selected will remain in the output's memory until a new value is entered or the sensor type is changed, even if the instrument is turned off.

If the display indicates **Under range!** or **Over range!** when you press "Enter", the new value you tried to load is either under or over the range of your selected sensor. This message will remain on the display for about 10 seconds, after which the lowest (if **Under range!** was dis - played) or the highest (if **Over range!** was displayed) temperature in your sensor's range is displayed.

NOTE While in one of the output modes, ramping up or down also changes the value of that output's memory. See Section 2-7, pages 10 & 11.

ramp step

To change the ramp step (the value by which the instrument will increment or decrement when it is in the ramp mode and the Δ (up) or ∇ (down) keys are pressed):

Press the "Select" key. The display will indicate:

```
Select _
```

NOTE If you press the "Select" key by mistake, you can return to the previous mode by pressing the "Select" key again.

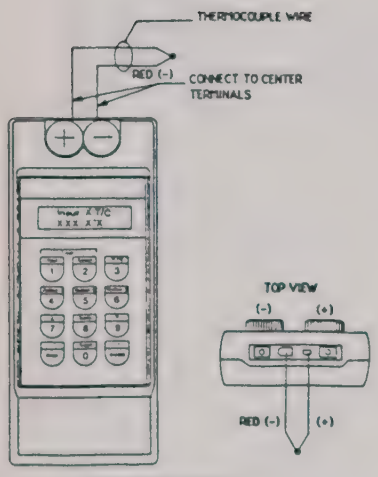
Press the "Ramp" key. The display will indicate:

Select Ramp step (current ramp step)

Use the numeric keypad to input a new ramp step value into the instrument. If you make a mistake, press "Clear" keys ("Input" and "Sensor" keys, simultaneously) and start over. The greatest ramp step value is 999.9° or 99.999 mV depending on the sensor selected.

Press "Enter" to input the new value into the instrument's memory. The new ramp step value will remain in memory until you change it, or a new sensor is selected.

2-6 input mode



THERMOCOUPLE INPUT
Figure 2.1

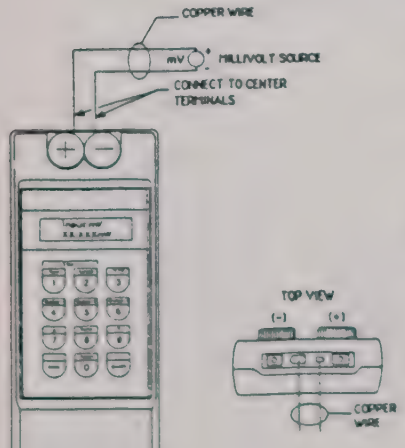
thermocouple input

Connect your thermocouple leads to the instrument's two center terminals, observing polarity (in the U.S., the red thermocouple lead is always negative). See Figure 2.1.

NOTE Try not to touch the ends of the wire or plugs with your fingers as this will warm the cold junction of the thermocouple and cause erroneous readings until the wire returns to ambient temperature. Configure the instrument to the thermocouple type you are using. See Section 2-5, page 6.

Read the temperature on the display.

millivolt input



MILLIVOLT INPUT
Figure 2.2

Connect the millivolt source to the instrument's two center terminals with copper leads, observing polarity. See Figure 2.2.

Select the mV sensor. See Section 2-5, page 6.

Read the millivolt input on the display.

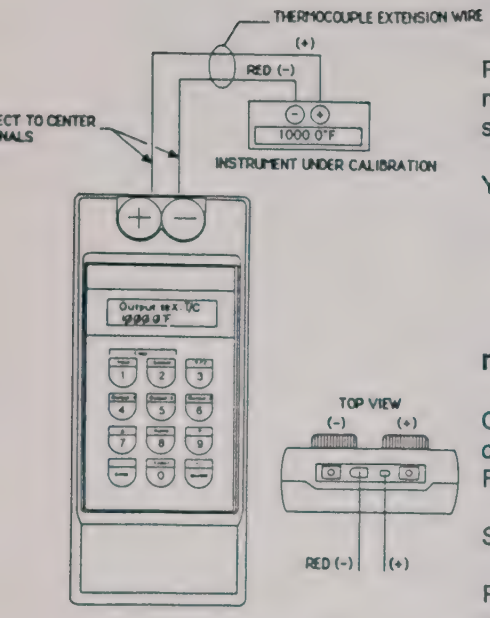
2-7 output mode

thermocouple output

Connect the appropriate thermocouple leads to the two center terminals of the indicator/calibrator and to the instrument to be calibrated, observing polarity. See Figure 2.3.

NOTE Extension leads for J, K, T & E thermocouples are furnished with the Portable Temperature Laboratory. Extension wire may be purchased separately.

Set the instrument to the to the thermocouple type you are simulating. See Section 2-5, page 6.



THERMOCOUPLE OUTPUT
Figure 2.3

Press one of the output keys, "Output 1, 2 or 3", to enter the output mode. The instrument will now output and display the contents of the selected output memory.

You can change the output's value in 2 ways:

1) Change the output memory values as you did in Section 2-5, page 6; or 7
2) Ramp to a new value. See Section 2-7, page 10.

millivolt output

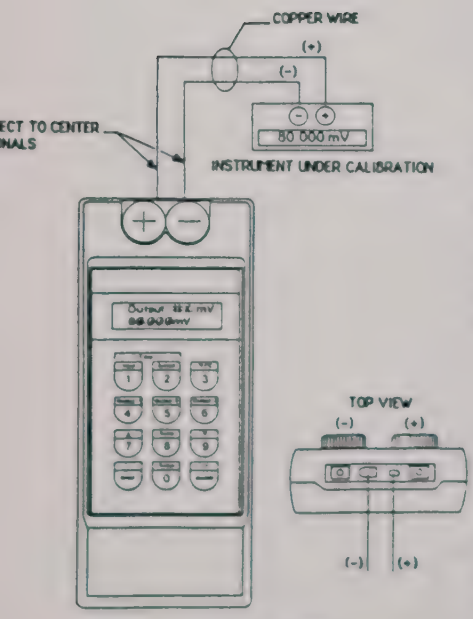
Connect copper leads to the two center terminals of the indicator/ calibrator and to the instrument to be calibrated, observing polarity. See Figure 2.4.

Set the indicator/calibrator to millivolts (mV).

Press one of the output keys, "Output 1, 2 or 3", to enter the output mode. The instrument will now output and display the contents of the selected output memory.

You can change the output's value in 2 ways:

1) Change the output memory values as you did in Section 2-5, page 7; or
2) Ramp to a new value. See Section 2-7, page 10.



MILLIVOLT OUTPUT
Figure 2.4

output ramp

entering ramp mode

Press one of the output keys, "Output 1, 2 or 3", to enter the output mode.

Press the "Ramp" key. If the instrument is configured for Type J thermocouples and the "Output 1" key is pressed, the display will indicate:

```
Ramp = 100.0 J T/C
Out 1: -346.0°F
```

This display shows that the instrument is configured for Type J thermocouple, Output #1 is selected, the current contents of Output #1's memory is -346.0°F (Output 1 indicates the lowest temperature, Output 2 indicates the middle temperature and Output 3 indicates the highest temperature of the range selected, unless programmed otherwise) and that the current ramp step is 100.0°.

Pressing the Δ (up) and ∇ (down) keys will increase or decrease the display by the ramp step. This feature is useful when calibrating or checking instrument alarms and controller proportional band or deadbands. By holding these keys down, the temperature will quickly increase or decrease, by the ramp step, until an **Over range!** or **Under range!** message appears.

As you ramp a selected output memory, you are changing the contents of that memory.

If you want to change the value of the ramp step, please refer to Section 2-5, page 8.

exiting ramp mode
There are 2 ways to exit the ramp mode:

(1) Pressing the "Ramp" key will take you out of the ramp mode and return you to the regular output mode. You will then be outputting the same value as you were in the ramp mode.

NOTE When you leave the ramp mode and re-enter the normal output mode, pressing the Δ (up) or ∇ down) keys will increase or decrease the display by the least significant digit, rather than the ramp step. This will also change the selected output's memory contents.

(2) Pressing the "Input" key will return the instrument to the input mode. The sensor type and other configuration parameters will remain the same.

exiting output mode

You may exit the output mode and return to the input mode at any time by pressing the "Input" key.

2-8 using the 12-point switch module

The optional 12-point switch module is plugged directly into the instrument's two center terminals. Correct polarity will be insured if the knob on the switch faces the front of the instrument.

Up to 12 separate thermocouples may be connected to the module simultaneously. Because the module is copper wired , you may use it for any type, or-combination of types of thermocouples . Turning the module's rotary switch will enable you to easily read the temperature of any thermocouple you select.

NOTE A difference in temperature between the module's terminals and the instrument's terminals would cause a corresponding error in the temperature reading. For example, if there were a 3° difference in the temperature of the module's terminals and the instrument's terminals, there would be a 3° error in the temperature reading.

section 3 maintenance

3-1 general maintenance

Under the terms of the warranty (discussed fully in Section 4 of this manual), Thermo Electric warrants the Micromite T to be free from all defects in material and workmanship for a period of two years... and Thermo Electric's liability is limited to the repair or replacement of the product only if failure occurs during the warranty period ***and factory inspection shows no external effects or customer repair altered the functioning of the instrument.***

As the Micromite T is a complex and sophisticated electronic instrument and you risk voiding your warranty under the terms described above, any repair or replacement of parts should be attempted only by technically qualified individuals.

While recalibration of the Micromite T can be done in the field if you have the following equipment and trained personnel, we strongly recommend you return the Micromite T to Thermo Electric for any other service:

equipment required for recalibration

- Adjustable mV standard, 0 to 99.000 mV, 0.0001 mV resolution, with an accuracy of ±0.0005 mV
- Low EMF and low resistance shorting terminal (gold or copper) or 0.0000 mV standard, with an accuracy of ± 0.0005 mV
- Stirred ice bath (32.00°F), with an accuracy of ± 0.05°F
- ISA J precision reference thermocouple with a known error at a temperature differential between room temperature and ice (32.0°F), with an accuracy of ± 0.05°F (± 0.001 mV)
- Adjustable power supply (5.0 - 9.0 volts @ 100 mA), with an accuracy of ± 0.05 V

The recalibration procedure is included in the optional Micromite T Service Manual which can be ordered from Thermo Electric.

3-2 troubleshooting guide

The following is a basic troubleshooting guide which can be used to help identify and correct problems that may occur with the Micromite T.

If you are unable to perform these checks or they do not correct the problem, you can call a Thermo Electric Instrument Service Representative at the factory (201) 843-5800 who may be able to help you resolve the problem over the phone.

If the problem still cannot be resolved, the Micromite T should be returned to the factory or to a Thermo Electric Instrument Service Center for repair. If this is necessary, please follow these instructions:

1 Pack the Micromite T carefully; to prevent shipping damage.

2 Include a brief note with a description of the problem and your company's name, address, phone number, your name and any other identifying data required to contact you or return the instrument.

3 If you don't know the location of your nearest Instrument Service Center, call your Thermo Electric representative or your nearest Thermo Electric Regional Office. A list of these Regional Offices is included in Section 5 of this manual.

4 Send the Micromite T, prepaid, to the nearest Thermo Electric Service Center or to the factory:

Thermo Electric Co.
109 North Fifth Street
Saddle Brook, NJ 07662
Attn: Instrument Service Department

5 If you're sending the Micromite T to the factory, please call first to obtain a Material Return Authorization (MRA) number. Be sure to place that number on the outside of the carton in which you ship the instrument.

Symptom	Possible Cause	Corrective Action
No display (Micromite T will not turn on)	Dead batteries.	Replace batteries use AC adapter.
	Batteries not inserted properly or dirty battery terminals.	Remove batteries. Clean terminals and reinsert batteries observing polarity indicated in the battery compartment.
	AC outlet not plugged into instrument or wall properly or AC outlet not functional.	Check connections. Try another outlet.

Symptom	Possible Cause	Corrective Action
Display indicates: **Caution** **Replace Battery**	Batteries not inserted	Remove batteries. Clean terminals and reinsert batteries observing polarity indicated in the battery compartment.
Even with new batteries or while working on AC adapter	If using adapter, may be using wrong adapter or line voltage may be too low or occasionally dipping.	Make sure AC adapter is specified for your line voltage. Try using line conditioner or operate instrument on batteries.
Display indicates **Reset** **Please Turn Off**	Instrument turned off by removing power (eg unplugging adapter while instrument is on, power failer or removing batteries while instrument is on)	Turn instrument off and on again, Sensor will default to Type J. See Section 2-3, page 5.
	Input wires and/or instrument may be to close to an EMI/RFI source (e.g. a large inductor or RF transmitter).	Place input wires and/instrument sone distance from interference source to prevent noise pick-up. Turn instrument off and on again. Sensor will default to Type J.
	If using adapter, may be using wrong adapter or line voltage may be too low or occasionaly dipping.	Make sure AC adapter is specified for your line voltage. Try using line conditioner or operate instrument on batteries. If after checking the above, this diplay continues, return for service.
Display indicates: Sensor is open!	Possible open input circuit or broken thermocouple lead.	Check sensor and terminal wires.
	"+" and/or "-" knobs may not be fully tightened.	Tighten knobs. Do not overtighten.
Input indication is incorrect	Thermocouple or copper wires may be connected backwards or incorrectly.	Refer to Section 2-6, page 9.
	Instrument may be in output mode instead of input mode.	Return instrument to input mode. Refer to Section 2-7, page 9.
	Instrument is set for wrong sensor type.	Refer to Section 2-5, page 6.
	Thermocouple is defective.	Verify correct instrument operation by placing it in any thermocouple range, except Type B. Short the input. If the instrument is working properly, it should indicate room temperature.

Symptom	Possible Cause	Corrective Action
	Poor thermocouple placement.	Verify thermocouple placement at measuring point.
Incorrect output	Thermocouple or copper lead wires may be connected backwards or incorrectly.	See Section 2-7, pg. 9.
	Instrument is set for wrong sensor type.	Refer to Section 2-5, page 6.
	Instrument is in input instead of output mode.	Enter output mode. Refer to Section 2-7, page 9.
	Possible broken leads or connecting wire.	Check leads or use known working leads.
	"+" and/or "-" knobs may not be fully tightened.	Tighten knobs. Do not overtighten.
Input indication jumps when in input mode or output signal jumps when in output mode.	Input/output wires and/or instrument may be placed too close to EMI/RFI source (e.g. a large inductor or large RF transmitter).	Place input/output wires and/or instrument some distance from interference source to prevent noise pick-up.
		Shield input/output wires.
	If in output mode, output may not yet be settled.	Allow time for settling. Refer to specs in Section 6.
	"+" and/or "-" knobs may not be fully tightened.	Tighten knobs. Do not overtightened.
	If using adapter, may be using wrong adapter or line voltage may be too low or occasionally dipping.	Make sure AC adapter is specified for your line voltage. Try using line conditioner or operate instrument on batteries.
		If problem persists, return instrument for service.

section 4 warranty

Thermo Electric Co. warrants the Micromite T to be free from defects in material and workmanship for a period of two years, commencing on the date of shipment from Thermo Electric Co.

In addition, Thermo Electric warrants the original or an subsequent factory calibration for 6 months, provided the Micromite T requires no other service during that 6 month period.

The liability of the seller is limited to the repair and replacement of the product only if failure occurs during the warranty period and factory in spection shows no external effects or customer repair altered the functioning of the instrument.

The instrument is to be returned to Thermo Electric Co. or the nearest Thermo Electric Authorized Service Center, freight prepaid, via the most economical surface transportation method, after authorization by Thermo Electric Co. All charges for handling, reinstalling and miscellaneous expenses incurred will be the responsibility of the buyer.

When factory examination shows the returned instrument to be within the above warranty period, the equipment will be repaired or replaced, at the seller's option, at no charge to the buyer.

This warranty shall be rendered null and void when, in the judgement of qualified Thermo Electric Co. personnel, the equipment has been subjected to abnormal or abusive use or lack of proper care or maintenance by the buyer, or when it has been determined that environmental conditions have exceeded those specified by Thermo Electric Co.

Any alteration or repair of the instruments by the buyer or any party not authorized by Thermo Electric Co. without our specific consent, in writing, shall automatically terminate our warranty obligation.

This warranty on instruments manufactured and/or sold by Thermo Electric Co., or any service provided by us, is expressely in lieu of all other warranties expressed or implied. No warranty is made of merchantability or fitness for any particular purpose.

No agent is authorized to assume any liability for it or to make any written or oral warranties or obligations beyond those set forth herein, unless endorsed, in writing, and signed by an officer of Thermo Electric Co.

section 5 instrument service

Thermo Electric has Instrument Service Centers throughout the United States and in Canada and Europe. For the location of the Instrument Service Center closest to you, call your Thermo Electric representative or your nearest Thermo Electric office.

However, until you're notified otherwise, the Micromite T will be serviced only by the Instrument Service Department at the factory (Saddle Brook, NJ address).

United States and World Headquarters

Thermo Electric Co.
109 North 5th Street
Saddle Brook, NJ 07662
(201) 843-5800
FAX: (201) 843-7144

Eastern Region

Thermo Electric Co.
109 North 5th Street, Suite 200
Saddle Brook, NJ 07662
(201) 791-9683 and 84
FAX: (201) 791-1505

Southeastern Region

Thermo Electric Co.
3440 Oakcliff Road, Suite 128
Atlanta, GA 30340
(404) 451-3733
FAX: (404) 451-5822

Central Region

Thermo Electric Co.
6909 Engle Road
Cleveland, OH 44130
(216) 243-2400
FAX: (216) 243-2401

Southwestern Region

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section 6 specifications

ambient operating temperature	0° to 55°C (32° to 131 °F)
storage temperature (without batteries)	-20° to 70°C (-4° to 158°F)
warm up time (time required to meet full specifications)	15 minutes under normal ambient conditions
normal mode rejection	>50 db @ 60 Hz
common mode rejection	>125 db with AC adapter @ 230 VRMS, 60 Hz
temperature stability	30 ppm of reading/degree (max)
input/output resolution	
thermocouples	0.1°
millivolts	0.001 mV
input impedance	100 MΩ
input leakage current	< 10 nA
input error due to source resistance	1 µV/100Ω
output impedance	≤ 0.005 ohms; output into a fixed load
output drive capability	45Ω fixed load (min) @ 100 mV output (max) 35Ω fixed load (min) @ 80 mV output (max) 15Ω fixed load (min) @ 40 mV output (max) 10Ω fixed load (min) @ 25 mV output (max)
Output settling time	
thermocouples	settles to within 0.5°F in <3 seconds
millivolts	settles to within 0.008 millivolts in <3 seconds
thermocouple output compensation	fully compensated for changes in ambient temperature
RJC error @ 25°C	± 0.1°F (max)
RJC compensation error	
J, K, T, E, N, Platinel II	0.02 deg/deg* (max)
R, S, B, W5/W26	0.05 deg/deg* (max)
	*deg/deg = $\frac{\text{T deg error}}{\Delta T_{amb} \text{deg}}$
power	6 disposable AA batteries for AC adapter, 115 or 230 VAC, 50/60 Hz
power consumption (AC)	0.5 Watts (max)
battery life (alkaline batteries)	
continuous use	50 hours (min) @ 75°F
normal use	>70 hours @ 75°F
shelf life	>6 months @ 75°F
case material	polycarbonate (G.E. Lexan™, Grade 141)
cover material	polypropylene
membrane keypad material	polyester
weight (with batteries)	28 ounces

external dimensions	
length	8.6"
width	3.75"
depth	2.38"
display	2 lines of 16 alphanumeric characters, 5 x 7 matrix LCD
display update rate	2 updates/second
calibration uncertainty (Thermo Electric's instruments' traceability to NBS)	
thermocouples:	
J, K, T, E, N, Platinel II	± 0.25°F (max)
R, S, B, W5/W26	± 1.2°F (max)
millivolts	± 0.0035 mV (max)
long term calibration stability	
thermocouples:	
J, K, T, E, N, Platinel II	± 0.1°F/month (max)
R, S, B, W5/W26	± 0.3°F/month (max)
millivolts	± 0.001 mV/month (max)
recommended calibration interval (period over which instrument will meet stated accuracy)	6 months

ISA Calibration	Available Range	Resolution	Accuracy Range(s)	Typical Accuracy 32°F (0°C) to 90% of span	Overall[1] Accuracy
J[2]	-346.0 to 2192.0°F	0.1°F	-346.0 to 2192.0°F	±0.25°F	±0.7°F
	-210.0 to 1200.0°C	0.1°C	-210.0 to 1200.0°C	±0.14°C	±0.4°C
K[2]	-362.0 to 2500.0°F	0.1°F	-310.0 to 2500.0°F	±0.25°F	±0.9°F
	-194.4 to 1371.1°C	0.1°C	-190.0 to 1371.1°C	±0.14°C	±0.5°C
T[2]	-340.0 to 752.0°F	0.1°F	-340.0 to 752.0°F	±0.25°F	±0.8°F
	-206.7 to 400.0°C	0.1°F	-206.7 to 400.0°C	±0.14°C	±0.4°C
E[2]	-320.0 to 1832.0°F	0.1°F	-320.0 to 1832.0°F	±0.25°F	±0.9°F
	-195.6 to 1000.0°C	0.1°C	-195.6 to 1000.0°C	±0.14°C	±0.5°C
N[3]	32.0 to 2372.0°F	0.1°F	32.0 to 2372.0°F	±0.25°F	±0.9°F
	0.0 to 1300.0°C	0.1°C	0.0 to 1300.0°C	±0.14°C	±0.5°C
W5/W26[4]	32.0 to 4200.0°F	0.1°F	32.0 to 4200.0°F	±0.36°F	±1.3°F
	0.0 to 2315.6°C	0.1°C	0.0 to 2315.6°C	±0.20°C	±0.7°C
Platinel II[5]	-140.0 to 2543.0°F	0.1°F	-140.0 to 2543.0°F	±0.25°F	±0.9°F
	- 95.5 to 1395.0°C	0.1°C	- 95.5 to 1395.0°C	±0.14°C	±0.5°C
R[2]	0.0 to 3200.0°F	0.1°F	32.0 to 3200.0°F	±0.8°F	±1.7°F
	- 17.8 to 1760.0°C	0.1°C	0.0° to 1760.0°C	±0.5°C	±0.9°C
S[2]	0.0 to 3200.0°F	0.1°F	32.0 to 3200.0°F	±0.8°F	±1.7°F
	- 17.8 to 1760.0°C	0.1°C	0.0° to 1760.0°C	±0.5°C	±0.9°C
B[2]	1000.0 to 3300.0°F	0.1°F	1000.0 to 3300.0°F	±0.8°F	±1.7°F
	537.8 to 1815.6°C	0.1°C	537.8 to 1815.6°C	±0.5°C	±0.9°C
mV	-9.999 to 99.999mV	0.001mV	-9.999 to 99.999mV	±0.003mV	±0.010mV

[1] At 75°F ±5°F within 6 months after calibration
[2] Conformity based on IPTS-68: NBS Monograph 125
[3] Conformity based on NBS Monograph 161 (AWG 14)
[4] Conformity based on Hoskins Manufacturing Co., W5/W26 T/C
[5] Conformity based on Engelhard Platinel II T/C